

# NEW DESCRIPTIONS

## DELTOCEPHALINE LEAFHOPPER GENUS *GONIAGNATHUS* (HEMIPTERA : CICADELLIDAE) IN THE INDIAN SUBCONTINENT WITH DESCRIPTIONS OF FOUR NEW SPECIES<sup>1</sup>

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(With sixty-five text-figures)

**Key words:** Leafhoppers, *Goniagnathus*, Indian subcontinent, new species, Cicadellidae

Five of the six valid species of the genus *Goniagnathus* Fieber known from the Indian subcontinent, namely *G. appellans* Baker, *G. fumosus* Distant, *G. guttulinervis* (Kirschbaum), *G. nervosus* Melichar and *G. punctifer* (Walker) are redescribed and illustrated. *G. bifurcata* Ahmed & Qadeer known from Karachi (Pakistan) is treated here as a junior synonym of *G. guttulinervis* (Kirschbaum). Four new species, namely *Goniagnathus concavus* sp. nov., *G. quadripinnatus* sp. nov., *G. symphysis* sp. nov., and *G. syncerus* sp. nov., have been described and illustrated. Three groups of species have been recognised in the genus *Goniagnathus*; i) the *guttulinervis* group which includes *guttulinervis* (Kirschbaum), *obfuscatus* Linnavuori, *parvipictus* Linnavuori, *albomarginatus* Linnavuori and *hanifanus* Dlabola, ii) the *punctifer* group including *appellans* Baker, *concavus* sp. nov., *fumosus* Distant, *nervosus* Melichar, *punctifer* (Kirschbaum), *quadripinnatus* sp. nov. and *appendiculatus* Linnavuori, and iii) the *syncerus* group including *symphysis* sp. nov. and *syncerus* sp. nov. A key to the species of *Goniagnathus* from the Indian subcontinent is also included.

### INTRODUCTION

The deltocephaline genus *Goniagnathus* Fieber belongs to the tribe Goniagnathini and includes very distinctive leafhoppers having short and broad heads, male subgenital plates fused and the connective reduced and fused with the aedeagus. They are brown to dark brown, robust leafhoppers, breeding on grasses and herbs. The genus is known to occur in the Palaearctic (28 species), Afrotropical (13 species) and the Oriental regions (7 species). Linnavuori (1978), while revising the genus for the Afrotropical region, redefined the tribe as well as the genus. Distant (1908, 1918) added six species of *Goniagnathus* from the Indian subcontinent. However, Kumar (1983) transferred *G. uniformis*

Distant to the genus *Batracomorphus* Lewis. Ahmed *et al.* (1988) described *G. bifurcatus* Ahmed and Qadeer as a new species from Karachi (Pakistan). Rama Subba Rao (1994) recorded *G. guttulinervis* (Kirschbaum) from the Indian subcontinent, in addition to redescribing *G. nervosus* Melichar from Kerala, thus bringing the total number of species to seven.

The institutions from where the leafhopper study material was obtained, and their abbreviations, are as follows.

BMNH - The Natural History Museum, London, U.K.

NPC - National Pusa Collection, Indian Agricultural Research Institute, New Delhi.

MMB - Moravian Museum, Brno, Czech Republic

UAS - The University of Agricultural Sciences, GKVK, Bangalore.

No attempts were made to redescribe *Goniagnathus*, as Linnavuori (1978) has given a detailed description. However, the following additional characters are noted. Hind tibial

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spinulation  $R_1$   $10 \pm 2$ ,  $R_2$   $10 \pm 2$ ,  $R_3$  17-22. Platellae at apex of hind basitarsus are five in number, flanked by a spine on each side. Female seventh sternum broader than long, hind margin variously excavated in the middle or concave. The first pair of female valvulae has scale-like sculpturing. The second pair of valvulae bear prominent teeth on dorsal margin and with crenulate margin between teeth and ventroapical margin.

On the basis of the male genitalia, the species studied and recognised here can be divided into three groups.

1. **The guttulinervis group:** Male pygophore without dorsal appendage, lobes with numerous setae. Aedeagus complex, with a pair of ventral atrial processes exceeding the compressed, short, simple shaft. The group includes only *G. guttulinervis* (Kirschbaum) from India. However, the following species from other zoogeographical regions also belong to this group: *G. obfuscatus* Linnavuori, *G. parvipictus* Linnavuori, *G. albomarginatus* Linnavuori (all from Afrotropical region, Linnavuori 1978) and *G. hanifanus* Dlabola (from Iran, Dlabola 1981).

2. **The punctifer group:** Male pygophore lobe with dorsal appendage, setae sparse. Aedeagus with tubular shaft having apical and subapical elongate processes. This group includes *G. appellans* Distant, *G. concavus* sp. nov., *G. fumosus* Distant, *G. nervosus* Melichar, *G. punctifer* (Walker) and *G. quadripinnatus* sp. nov. from the Indian subcontinent. *G. appendiculatus* Linnavuori from the Afrotropical region (Linnavuori 1978) also belongs to this group.

3. **The syncerus group:** Similar to the *punctifer* group in pygophore structure, but the aedeagal shaft is shorter, widening caudally. The gonopore is surrounded by a short, sclerotized process. This group comprises of only two species, *G. symphysis* sp. nov. and *G. syncerus* sp. nov.

KEY TO SPECIES OF *GONIAGNATHUS*  
OF THE INDIAN SUBCONTINENT

(*G. bicolor* Distant is not included in the key)

1. Male ..... 2  
— Female ..... 10
2. Male pygophore without dorsal appendage (Figs 1, 60) ..... 3  
— Male pygofer with dorsal appendage (Figs 7, 14, 21) ..... 4
3. Aedeagus with a pair of ventral processes exceeding shaft (Fig. 3) (Palearctic and Oriental) ..... *G. guttulinervis* (Kirschbaum)  
— Aedeagus without ventral process (Fig. 63) (India: Rajasthan) ..... *G. syncerus* sp. nov.
4. Aedeagus with long processes; shaft rather tubular, long and of uniform width ..... 5  
— Aedeagal shaft without any long process, constricted before apex (Figs 56, 57); gonopore surrounded by sclerotized rim ending in a lateral short projection (Fig. 55) (India: Gujarat, Maharashtra, Karnataka, Tamil Nadu) .....  
..... *G. symphysis* sp. nov.
5. Pygophore lobe strongly narrowed caudally with its appendage bordering caudo-dorsal margin only (Figs 7, 39) ..... 6  
— Pygophore lobe broad or broadened caudally, with its appendage bordering both caudo-dorsal and caudal margins (Figs 21, 31) ..... 9
6. Fused subgenital plates with concave caudal margin (Fig. 15); aedeagal shaft with a pair of ventral and a pair of dorsal processes at apical. 0.33 (Figs 17, 18) (India: Gujarat, Karnataka) ..... *G. concavus* sp. nov.  
— Fused subgenital plates either with truncate, convex or obtusely rounded caudal margin; aedeagal shaft with lateral and dorsal or lateral and apical processes ..... 7
7. Aedeagus with a pair of apical and a pair of rather asymmetrically curved processes arising at mid-length of shaft dorsally (Figs 41, 42); fused subgenital plates square tipped (Fig. 40) (India: Gujarat, Maharashtra, Karnataka, Mizoram, Meghalaya, Kerala; Sri Lanka) ..... *G. punctifer* (Walker)  
— Aedeagus with a pair of apical and a pair of subapical processes; fused subgenital plates obtusely or convexly rounded ..... 8

8. Fused subgenital plates broader at base than long, caudally convexly rounded (Fig. 46); apophysis of style with mesal lobe stouter and longer than lateral lobe (Fig. 47); lateral processes of aedeagal shaft stouter and longer than dorsal processes (Figs 48, 49) (India: Orissa, Karnataka).....  
..... *G. quadripinnatus* sp. nov.
- Fused subgenital plate as long as broad basally, narrowed caudally (Fig. 8), apophysis of style with equally developed lateral and mesal lobes (Fig. 9), lateral processes of aedeagal shaft slender and shorter than dorsal processes (Fig. 10) (India: West Bengal, Meghalaya, Maharashtra, Karnataka, Kerala, Lakshadweep Islands)..... *G. appellans* Baker
9. Fused subgenital plate with truncate hind margin, style extending beyond this plate (Figs 22, 23); aedeagal shaft with a pair of forked apical processes (Fig. 25) (India: Gujarat, Maharashtra, Karnataka, Kerala, Tamil Nadu, Andhra Pradesh) ..... *G. fumosus* Distant
- Fused subgenital plate with caudal margin slightly convex, medially notched (Fig. 32); styles not exceeding length of this plate; aedeagal shaft with a pair of dorsal, an unpaired ventral subapical process and a pair of basal prong-like processes (Fig. 33) (India: Andhra Pradesh, Maharashtra, Karnataka, Pondicherry, Kerala; Sri Lanka) ..... *G. nervosus* Melichar
10. Hind margin of seventh sternum concave (Fig. 28) or concavely excavated in the middle .... 11
- Hind margin of seventh sternum broadly produced caudally with a median notch (Fig. 44) ..... *G. punctifer* (Walker)
11. Hind margin of seventh sternum moderately concave; with a median notch (Fig. 37)..... 12
- Hind margin of seventh sternum deeply concave, without a median notch (Figs 28, 29) ..... *G. fumosus* Distant
12. Caudo-lateral angle of seventh sternum angular (Figs 13, 58) ..... 13
- Caudo-lateral angle of seventh sternum rounded (Figs 5, 37, 50) ..... 14
13. Hind margin of seventh sternum with a median V-shaped excavation (Fig. 58).....  
..... *G. symphysis* sp. nov.
- Hind margin of seventh sternum with a median C-shaped excavation (Fig. 13) .....  
..... *G. appellans* Baker
14. Seventh sternum with median length considerably shorter than lateral length ..... 15
- Seventh sternum with median length as long as lateral length (Fig. 37) .....  
..... *G. nervosus* Melichar
15. Seventh sternum with a median V-shaped excavation (Fig. 5) .....  
..... *G. guttulinervis* (Kirschbaum)
- Seventh sternum medially roundly excavated with lateral margins sinuate (Fig. 50) .....  
..... *quadripinnatus* sp. nov.

***Goniagnathus guttulinervis* (Kirschbaum)**  
(Figs 1-5)

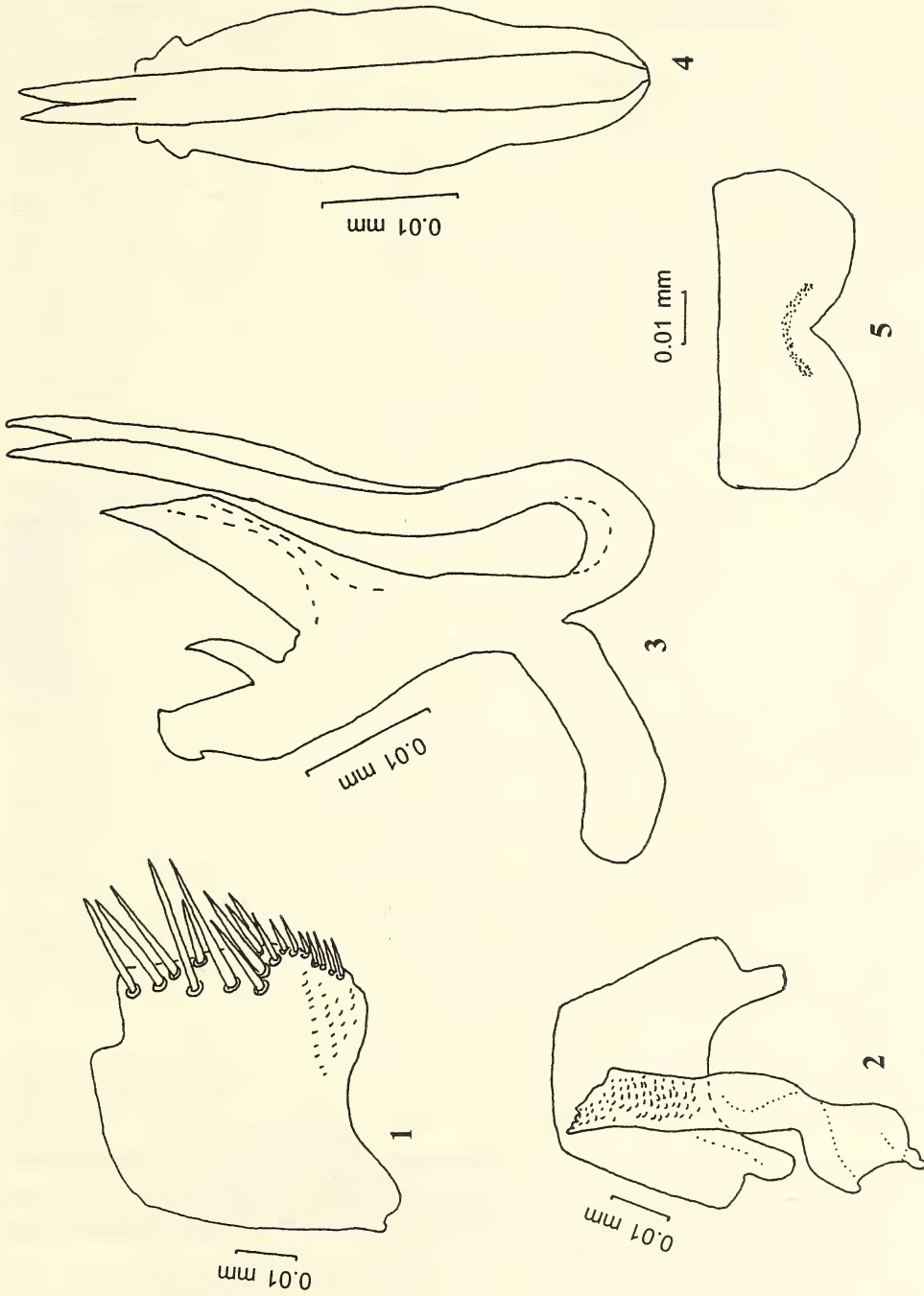
*Goniagnathus bifurcatus* Ahmed and Qadir in Ahmed *et al.*, 1988: 16. syn. nov.

This species has been well described and hence only the illustrations of the male and female genitalia of the Indian population are included.

**Material examined:** INDIA: Lakshadweep Is.: 16♂, 20♀, 13 nymphs, Minicoy, 16.i.1986, C.A. Viraktamath; 1♂, Bangaram, 14.i.1986, C.A. Viraktamath. Delhi: 15♂, 9♀, New Delhi, 1968, H.M. Harris; 1♂, 7.vii.1972; 2♂, 1.viii.1974; 3♂, 1♀, 4.x.1980, C.A. Viraktamath. Maharashtra: 1♀, Dhond, 2.x.1981, C.A. Viraktamath; 2♂, 6♀, Igatpuri, 23.iv.1980, C.A. Viraktamath. Gujarat: 1♀, Somnath, 29.i.1981, C.A. Viraktamath; 1♀, Dandi-Navsari, 16.i.1981, C.A. Viraktamath. Tamil Nadu: 1♀, Coimbatore, 14.viii.1979, S. Viraktamath. Rajasthan: 2♂, 2♀, Mt. Abu, 23-24.i.1981, C.A. and S. Viraktamath. Karnataka: 2♂, Raichur, 25.vi.1982, S. Viraktamath (UAS).

**Remarks:** *G. guttulinervis* can be recognised by the absence of dorsal pygophore appendage, lamellate aedeagal shaft arising from the long basal atrium at mid-length and with long falcate appendage on ventral aspect. Synonymy of *G. bifurcatus* is based on the study of male genitalia given by Ahmed *et al.* (1988).

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Figs. 1-5. *Goniagnathus guttulinervis* (Kirschbaum): 1. Male pygophore; 2. Fused subgenital plate and apex of style; 3. Fused aedeagus and connective, lateral view; 4. Aedeagus and ventral process, caudal view; 5. Female seventh sternum.



***Goniagnathus appellans* Baker**

(Figs 6-13)

*Goniagnathus obesus* Distant, 1918: 43. Lectotype ♂, India (BMNH, examined).

*Goniagnathus appellans* Baker, 1924: 367, new name for *Goniagnathus obesus* Distant, 1918 not Jacobi, 1910.

Ochraceous with reddish tinge on the vertex, pronotum and scutellum. Anterior margin of vertex with black and reddish-brown transverse bands. Interrupted black facial pattern. Antennal pit black, clypellus, lora and genae with irregular black markings.

Vertex four times as wide as long. Forewing with inner anteapical cell open behind and outer anteapical cell divided with a cross vein.

**Male genitalia:** Pygophore with dorsal appendage stout, not exceeding caudo-dorsal margin, lobe caudally narrowed and obtusely rounded with short marginal setae. Fused subgenital plate as long as broad, caudally rounded. Apophysis of style bilobed with prominent scale-like sculpturing, inner lobe longer than outer. Aedeagal shaft tubular, elongate, of uniform width, slightly curved, with an apical pair of long, anteriorly directed processes and a shorter subapical pair of anterolaterally directed processes, gonopore small, apical; dorsal apodeme 0.33x as long as shaft and half as long as preatrium.

**Female genitalia:** Seventh sternum width 3.0 times the median length, hind margin sinuate with a median notch.

**Measurements:** MALE 5.4 (5.1-5.9) mm long, 2.3 (2.1-2.5) mm wide across eyes. FEMALE 5.6 (5.3-6.2) mm long, 2.3 (2.2-2.5) mm wide across eyes.

**Material examined:** Lectotype ♂, left hand male of the two dissected males on the same card "Chikkaballapura, T.V. Campbell" "*Goniagnathus obesus* Dist. Type" designated here (BMNH). Paralectotypes: 34 ♀ ♂, with same data as in lectotype (BMNH).

**Other material examined:** INDIA:

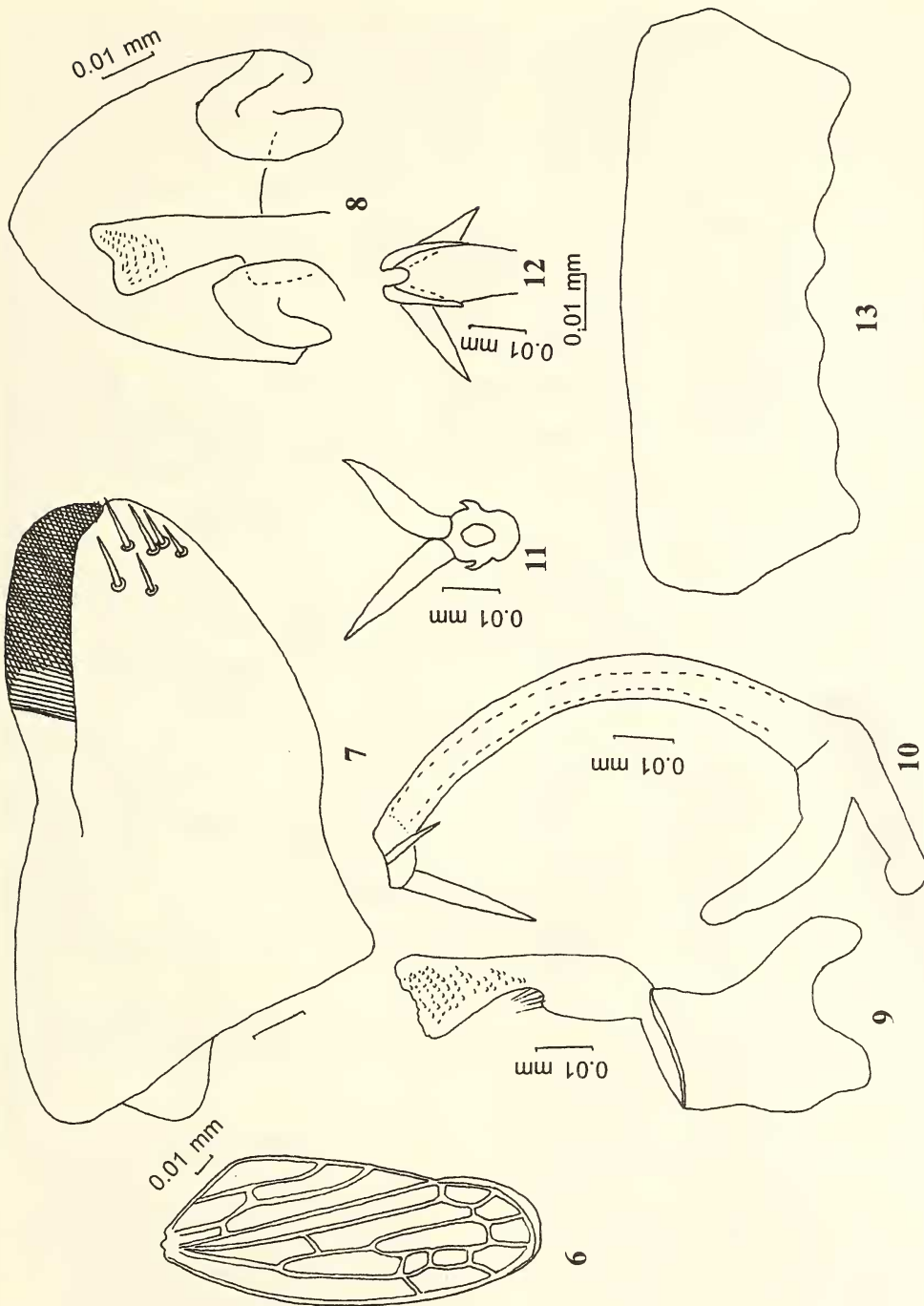
Karnataka: 2♀, Bangalore, 22.v.1991; 1♂, 1♀, 23.x.1991; 7♂, 7♀, 3.xii.1991; 7♂, 4♀, 1.vii.1992; 4♂, 1♀, 2.ix.1991; 2♀, 20.vii.1991; 10♂, 4♀, 10.ii.1992; 3♂, 9♀, 2.xi.1991; 4♀, 3.vi.1992; 1♀, 12.vii.1992, 1♀, 6.xi.1991, 1♂, 30.vi.1992; 1♂, 25.vi.1992, all coll. P.C. Dash; 2♂, 10.vii.1982, H.V.A. Murthy; 3♂, 4♀, 14.ix.1925, T.V. Subramanian; 1♂, 4♀, 5.vii.1977; 1♂, 12.vii.1979; 1, 24.i.1977, all collected by students; 4♂, 1♀, 8.iv.1976, B. Mallik; 3♂, 22.iv.1974; 2♂, 21.ii.1976; 1♀, 11.i.1975; 1♂, 6.ix.1974; 2♂, 21.i.1976; 1♀, 1.ii.1974, all coll. C.A. Viraktamath; 1♂, 1♀, 12.v.1990, A.R.V. Kumar; 6♂, 4♀, 26 km SE Bangalore, 6.ix.1992, P.C. Dash; 1♂, Nandi Hills, 17.vii.1992, P.C. Dash; 1♀, Dharwad, 22.iv.1972; 1♂, 21.v.1972; 6♂, 2♀, 14-30.viii.1972, all coll. C.A. Viraktamath; 4♂, 2♀, Raichur, 24.viii.1982; 1♂, 25.vi.1982, S. Viraktamath; 3♂, 1♀, Raichur, 18-21.ii.1976, C.A. Viraktamath; 2♂, 4♀, Sidlaghatta, 9.viii.1976, B. Mallik; 1♀, 1♂, Gulburga, 24.vii.1981; 1♀, 9.ix.1990, A.R.V. Kumar; 2♀, Bidar, 5.i.1991, A.R.V. Kumar. Kerala: 1♂, Walayar, 15.viii.1979, S. Viraktamath. Maharashtra: 1♂, 2♀, Nasik, 21.iv.1980, C.A. Viraktamath. West Bengal: 1♀, 9 km E Kalimpong 1,768 m, 29.x.1981, C.A. Viraktamath. Meghalaya: 1♀, Nangpoh, 762 m, 4.xi.1981, C.A. Viraktamath. Lakshadweep Islands: 1♀, Minicoy, 16.i.1986, C.A. Viraktamath (UAS).

**Remarks:** The structure of aedeagus of *G. appellans* is similar to that of *G. severus* (Stål), but has completely fused subgenital plates. It is related closely to *G. quadripinnatus* sp. nov., from which it differs in the shape and size of the aedeagal processes and subgenital plate.

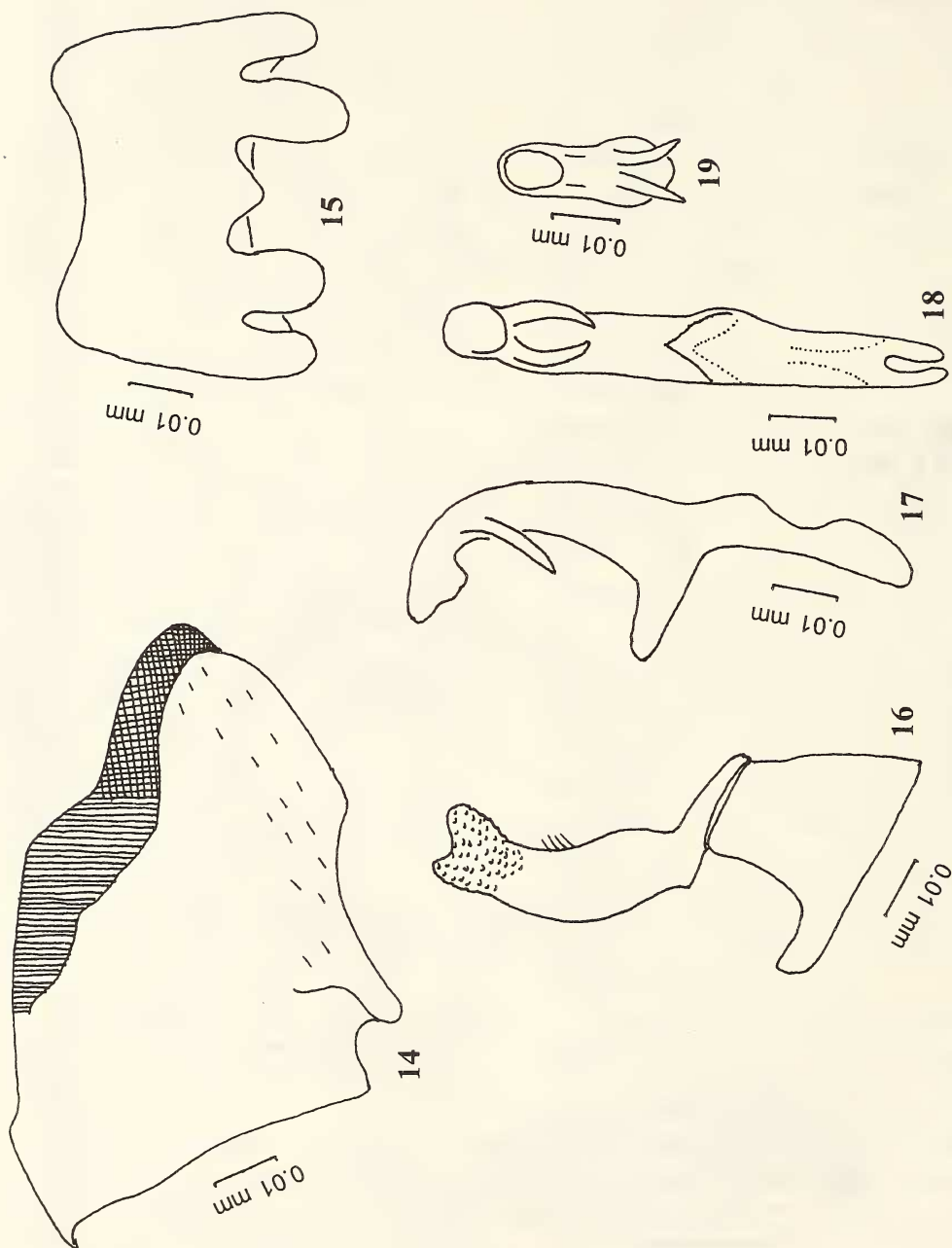
***Goniagnathus concavus* sp. nov.**

(Figs 14-19)

Reddish-brown; anterior margin of the



Figs 6-13: *Goniagnathus appellans* Baker: 6. Fore wing; 7. Male pygophore; 8. Fused subgenital plate and apex of style; 9. Style; 10. Fused connective and aedeagus, lateral view; 11, 12. Different views of apex of aedeagal shaft; 13. Female seventh sternum.



Figs 14-19: *Goniagnathus concavus* sp. nov.: 14. Male pygophore; 15. Fused subgenital plate; 16. Style; 17. Fused connective and aedeagus, lateral view; 18. Same, cephalic view; 19. Apex of aedeagal shaft.

vertex ivory, with dorsal and ventral broken brown stripes. Forewing venation mottled with white and brown. Legs transversely banded with dark brown, and bases of hind tibial spines black.

Vertex four times as wide as long. Forewing with inner anteapical cell closed behind by a cross vein.

**Male genitalia:** Pygophore longer than its height, dorsal appendage heavily sclerotised, black, not extending down caudal margin, setae slender, hair-like. Fused subgenital plate twice as broad as median length, caudal margin inwardly curved. Apophysis of style strongly bilobed apically. Aedeagus slender, tubular, distal 0.25 strongly dorsally recurved; a pair of dorsal and a pair of ventral processes on shaft at distal 0.33; gonopore caudal.

**Female:** Unknown.

**Measurements:** MALE 5.75 (5.6-5.9) mm long, 2.3 (2.2-2.4) mm wide across eyes.

**Material examined:** Holotype ♂ INDIA: Gujarat: Ahmedabad, 27.i.1981, C.A. Viraktamath (UAS). Paratypes: INDIA: Gujarat: 1 ♂, Dandi-Navsari, 16.i.1981, C.A. Viraktamath. Karnataka: 1 ♂, Bangalore, 916 m, 9.i.1980, A.R.V. Kumar (BMNH, UAS).

**Remarks:** This species differs from other species of *Goniagnathus* in having abruptly recurved apex of aedeagal shaft and inwardly curved caudal margin of the fused subgenital plate.

**Etymology:** *concaus* refers to the concave hind margin of the fused subgenital plates of the male.

*Goniagnathus fumosus* Distant

(Figs 20-29)

*Goniagnathus fumosus* Distant, 1918; 43.

Lectotype ♂, India (BMNH, examined).

Coloration as described by Distant (1918).

Vertex six times as wide as long. Forewing with inner anteapical cell closed behind by a cross vein.

**Male genitalia:** Pygophore with dorsal appendage reaching ventral margin, lobe caudoventrally produced into an angular prolongation without setae. Fused subgenital plates rectangular with rounded lateral margin, twice as broad as long. Apophysis of style with stout, elongated inner lobe and slender, smaller outer lobe; inner lobe exceeding fused subgenital plates. Aedeagal shaft tubular, with a pair of forked apical processes, mesal fork directed anteriorly, lateral fork laterally; gonopore large, apical; dorsal apodeme 0.33x as long as shaft, half as long as preatrium.

**Female genitalia:** Seventh sternum 3.0 times as wide as median length, hind margin deeply concave.

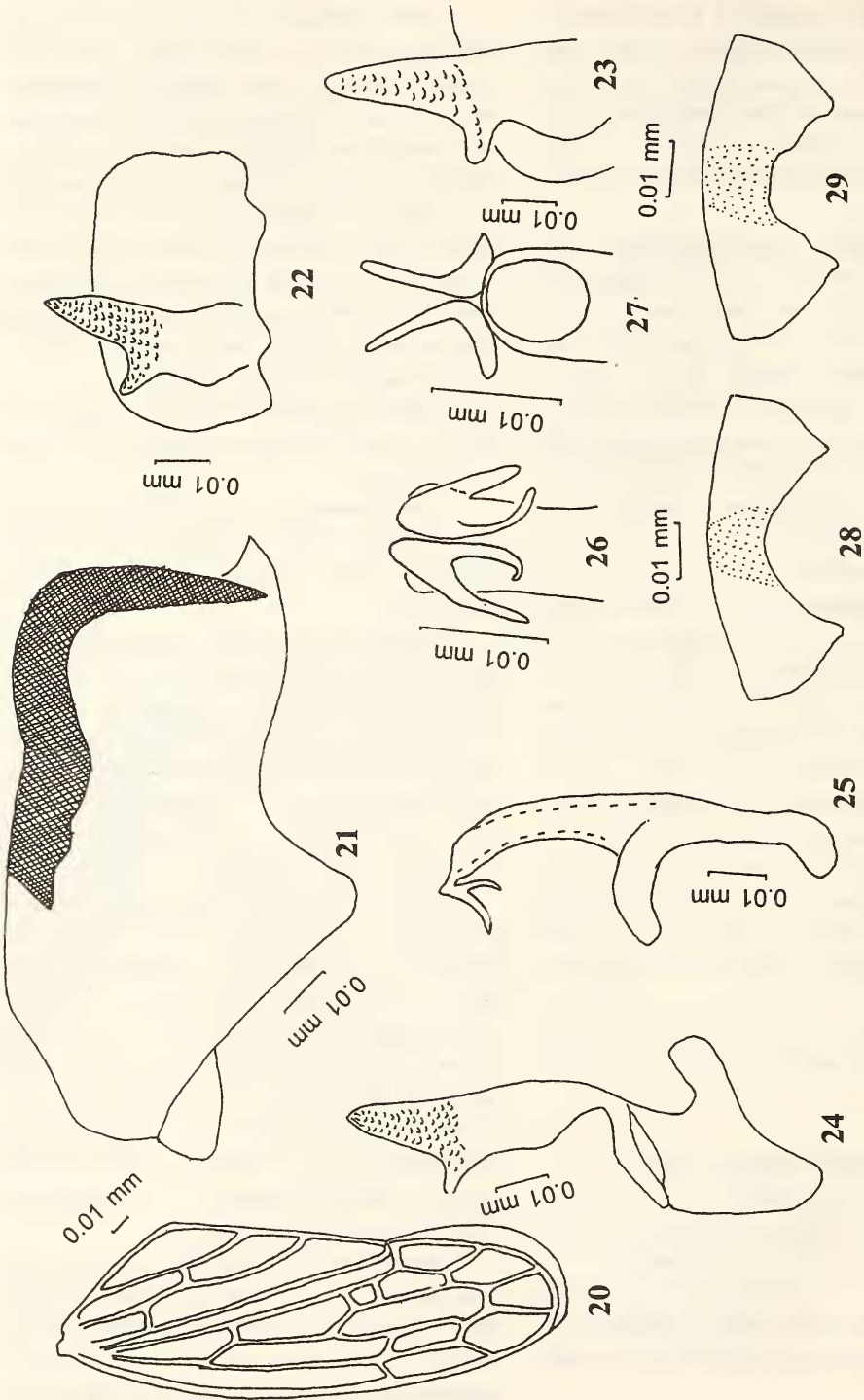
**Measurements:** MALE: 6.7 (6.4-6.8) mm long, 2.5 (2.4-2.6) mm wide across eyes. FEMALE: 6.3 (5.9-6.7) mm long, 2.5 (2.4-2.6) mm wide across eyes.

**Material examined:** Lectotype ♂, left hand male of the two dissected males on the same card "Chikkaballapura, S. India, T.V.C." "*Goniagnathus fumosus* Dist. Type" here designated (BMNH). Paralectotypes: 4 ♂, 5 ♀, data as for lectotype; 2 ♀, "Pusa Bihar, at light, TBF, 1.vii.14"(sic) 1 ♀, "Allahabad, August 1911, A.D. Imms" (BMNH).

**Other material examined:** INDIA: Karnataka: 2 ♀, Bangalore, (-).ix.1969, H.M. Harris; 1 ♀, 1.iv.1980, C.A. Viraktamath. Tamil Nadu: 2 ♂, 2 ♀, Trichy, 3-13.v.1989, K.R. Rao; 2 ♂, Pudukottai, 26.i.1985, K.R. Rao; 1 ♂, Kottampatty, 8.v.1984, K.R. Rao. Gujarat: 1 ♂, Junagadh, 30.1.1981, C.A. Viraktamath; 1 ♀, Sasan-Gir, 1.ii.1981, C.A. Viraktamath, Maharashtra: 1 ♂, 1 ♀, Dhond, 2.x.1981, A.R.V. Kumar. Andhra Pradesh: 1 ♂, Hyderabad, 30.iv.1992, ex. paddy (UAS).

**Remarks:** This species can easily be recognised by the forked aedeagal processes, dorsal pygophore appendage caudally abruptly curved at right angles and by the extension of apophysis of style beyond fused subgenital plates.





Figs 20-29: *Goniagnathus fumosus* Distant: 20. Forewing; 21. Male pygophore; 22. Fused subgenital plate and apex of style, specimen from Bangalore; 23. Apex of style, lectotype; 24. Style, specimen from Bangalore; 25. Fused connective and aedeagus, lateral view; 26, 27. Different views of apex of aedeagal shaft; 28, 29. Variation in the female seventh sternum.

***Goniagnathus nervosus* Melichar**

(Figs 30-37)

*Goniagnathus nervosus* Melichar, 1903: 180. Lectotype ♂, designated here by P. Lauterer, Sri Lanka (MMB, examined).

Reddish-brown, anterior margin of vertex ochraceous. Interrupted black fascia on face, vertex, pronotum and scutellum mottled with irregular reddish-brown spots. Forewing veins mottled with dark brown and white spots.

Vertex five times as wide as long. Forewing with inner anteapical cell closed behind by a cross vein.

**Male genitalia:** Pygophore constricted at mid-length and broadened caudally with a few hair-like setae apically, dorsal appendage entire caudal margin. Fused subgenital plate twice as broad as long, slightly convexly rounded with a median notch on caudal margin. Apophysis of style bilobed. Aedeagal shaft strongly curved caudo-dorsally and in apical 0.25 strongly curved anteriorly, with a basal pair of lateral short, stout processes at 0.25 distance, a slender elongate unpaired process on caudal margin directed caudo-dorsally at apical 0.33 and a pair of ventrally directed, slender processes arising subapically on anterior margin; gonopore large, apical; dorsal apodeme 0.25 as long as shaft, shorter than preatrium.

**Female genitalia:** Seventh sternum 2.5 times as wide as long, hind margin sinuate with a median notch.

**Measurements:** MALE: 6.3 (6.2-6.4) mm long, 2.4 (2.3-2.5) mm wide across eyes, FEMALE: 6.4 (6.1-6.5) mm long, 2.5 (2.4-2.6) mm wide across eyes.

**Material examined:** Lectotype ♂, "Ceylon/ Peradeniya/ März 1902/leg. Dr. Uzel/ DR MELICHAR" and "Transcriptio/ *Goniagnathus* ♂/ *nervosus* n.sp./ L. Melichar det. 1903/P. Lauterer det. 1996" and "Lectotypus/ *Goniagnathus* ♂/ *nervosus*/ Melichar 1903/ P. Lauterer design. 1996" (MMB).

Paralectotypes: 1 ♂, data as for lectotype, originally placed on the same block as lectotype, now separated and relabelled by Dr. P. Lauterer; 1 ♀, "Ceylon/ Peradeniya/ Juni 902/ leg. Dr. Uzel/ DR MELICHAR" and other data as in lectotype; 2 fifth instar nymphs, data as for lectotype (MMB).

**Other material:** INDIA: Karnataka: 1 ♂, 3 ♀, Jog Falls (534 m), 17-18.xi.1976, B. Mallik; 2 ♂, 1 ♀, Mudigere, 21.v.1975; 1 ♂, 3 ♀, 6.iv.1980; 2 ♂, 3 ♀, 21-22.v.1976, C.A. Viraktamath and B. Mallik; 1 ♂, Bangalore, 3.iv.1978, A.R.V. Kumar; 1 ♀, Biligirirangana Hills, 13.viii.1976, C.A. Viraktamath. Pondicherry: 2 ♂, Mahé, 15.ix.1979, A.R.V. Kumar. Maharashtra: Mahabaleshwar 1,381 m, 20.xi.1977, C.A. Viraktamath. Kerala: 2 ♂, Kottayam, 25.iii.1977, B. Mallik (UAS).

**Remarks:** This species is related to *G. concavus* sp. nov., but differs from it in having an unpaired ventral process to aedeagus and longer dorsal appendage to the pygophore.

***Goniagnathus punctifer* (Walker)**

(Figs 38-44)

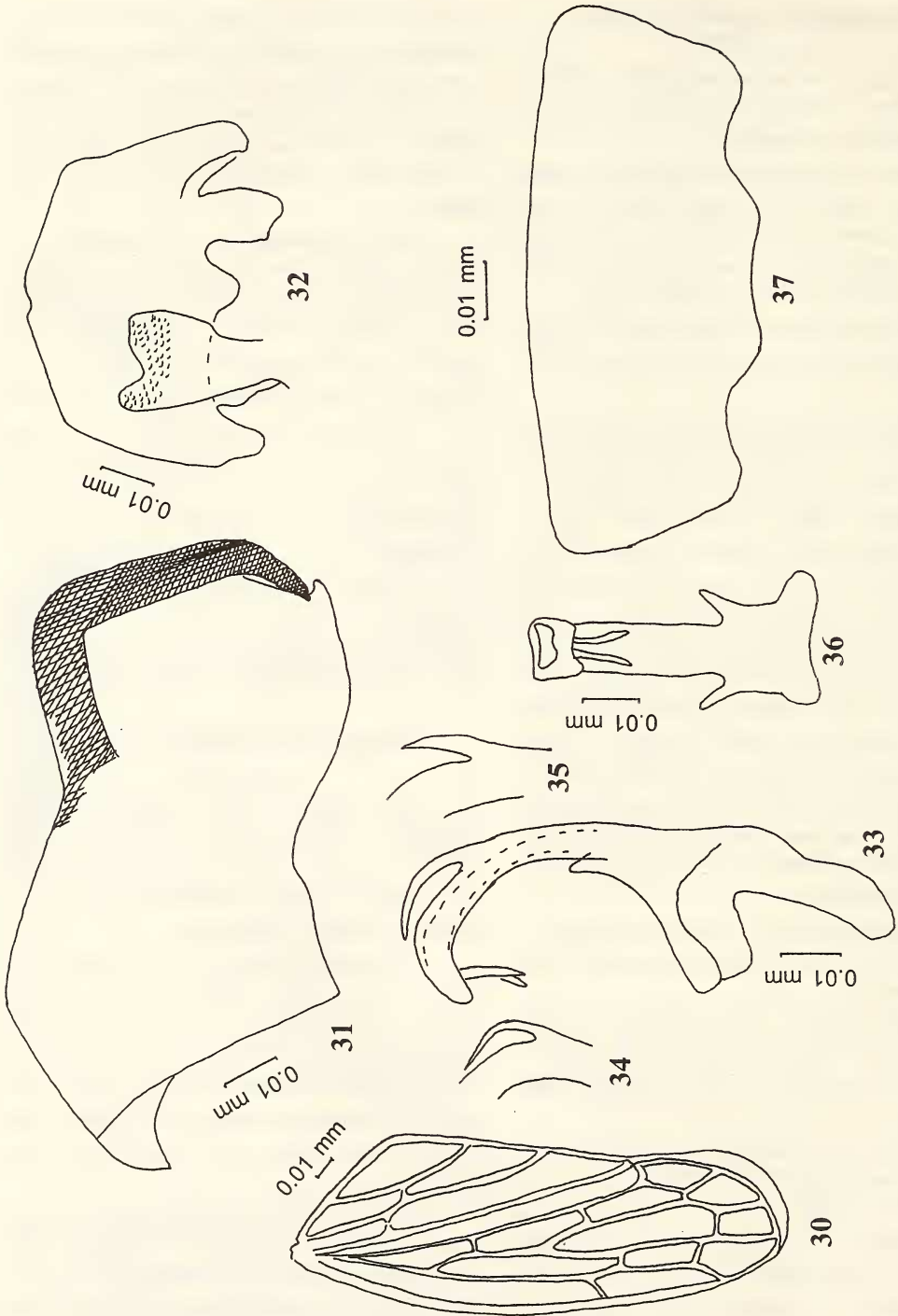
*Bythoscopus punctifer* Walker, 1858: 104. Lectotype ♂, India (BMNH, examined).

*Goniagnathus spurcatus* Melichar, 1903: 181. Lectotype ♂ designated here by P. Lauterer, Sri Lanka (MMB, examined).

Coloration as described by Distant (1908) with the following additions: Ochraceous, irregular reddish-brown markings on vertex, pronotum and scutellum. Anterior margin of vertex yellow with faint brownish spots. Face with interrupted black fascia, eyes black with reddish-brown margin and stripes. Forewings ochraceous.

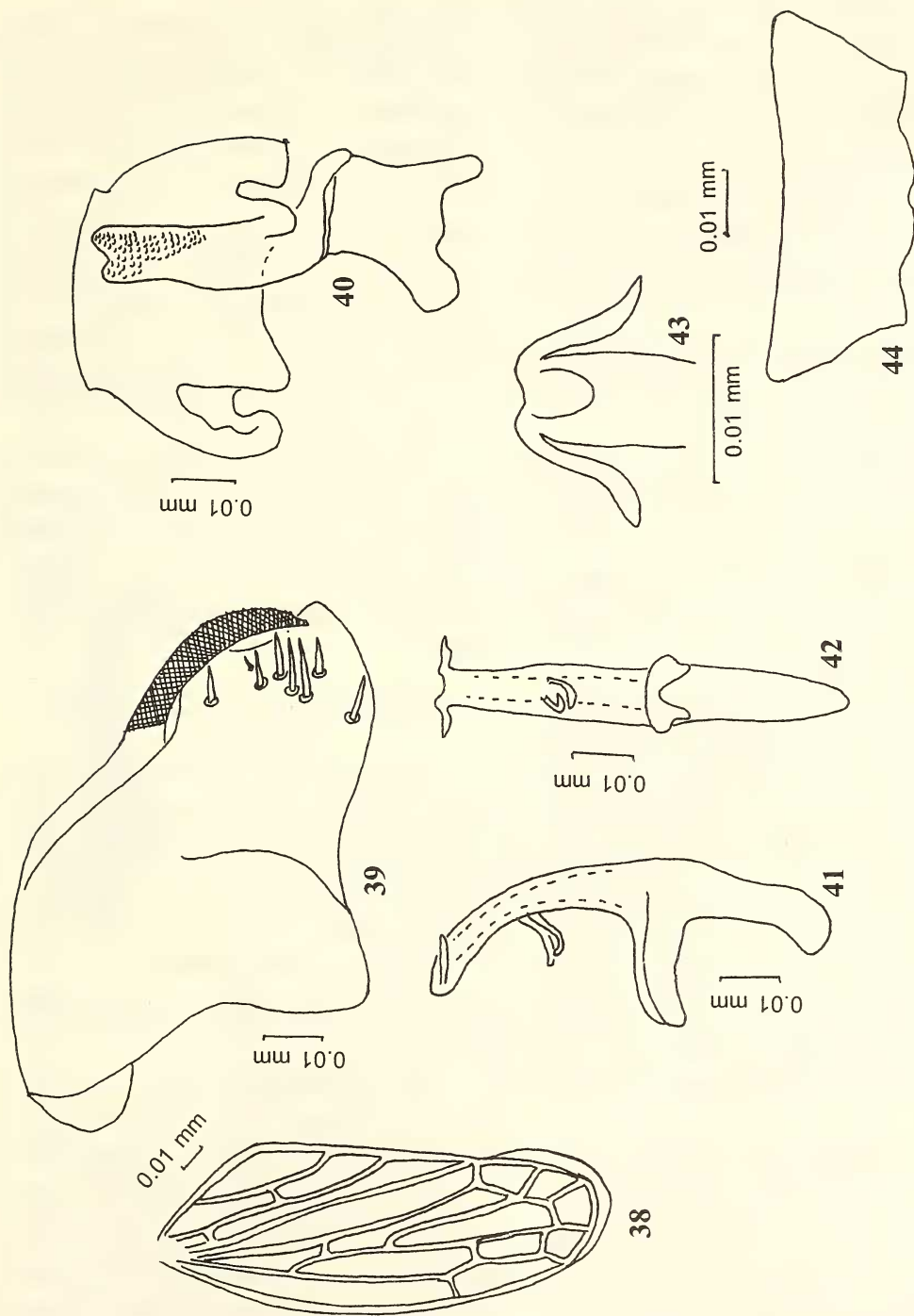
Vertex five times as wide as median length. Forewing with inner anteapical cell open behind.

**Male genitalia:** Pygophore caudally narrowed with an obtusely rounded caudal lobe having a few setae, dorsal appendage slender,



Figs 30-37: *Goniagnathus nervosus* Distant: 30. Forewing; 31. Male pygophore; 32. Fused subgenital plate and apex of style; 33. Fused connective and aedeagus, lateral view; 34, 35. Variations in the caudal process of aedeagus in lectotype and paralectotype; 36. Aedeagal shaft, cephalic view; 37. Female seventh sternum.

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Figs 38-44: *Goniagnathus punctifer* (Walker): 38. Forewing; 39. Male pygophore; 40. Fused subgenital plate and style; 41. Fused connective and aedeagus, lateral view; 42. Fused connective and aedeagus, cephalic view; 43. Apex of aedeagal shaft; 44. Female seventh sternum.



black, not reaching caudo-ventral angle. Fused subgenital plate twice as broad as median length, narrowed caudally with truncate apex. Style with bilobed apophysis, outer lobe slightly longer than inner. Aedeagal shaft slightly curved, with an apical pair of laterally directed processes, and a median pair of slightly asymmetrically curved processes on cephalic margin at mid-length; gonopore large, apical; dorsal apodeme less than half as long as shaft, shorter than preatrial extension.

**Female genitalia:** Seventh sternum three times as wide as long, hind margin broadly produced with a median notch.

**Measurements:** MALE: 5.7 (5.1-6.4) mm long, 2.2 (2.1-2.4) mm wide across eyes. FEMALE: 5.9 (5.6-6.4) mm long, 2.4 (2.3-2.5) mm wide across eyes.

**Material examined:** Lectotype ♂, "*punctifer* Walk" "Ind." "68<sub>4</sub>" here designated (BMNH). Lectotype ♂, "Ceylon VI/ Peradeniya (struck off)/ Colombo/ leg. Dr. Uzel/ DR MELICHAR" and "*spurcatus*/det. Melicha" and transcribed labels "Transcriptio/ *Goniagnathus/ spurcatus* sp. n./L. Melichar det. 1903/ P. Lauterer det 1996" and Lectotypus/ *Goniagnathus* ♂/ *spurcatus* Melichar 1903/ P. Lauterer design. 1996" and *Goniagnathus* ♂/ *punctifer*/ (Walker)/ P. Lauterer det. 1996" and Invent. C./ 3886/ Ent/ Mor. Museum, Brno" here designated by Dr. P. Lauterer (MMB). Paralectotype: 1 ♂, data as in lectotype, originally placed on the same block as lectotype, but now separated with inventory No. 3888/Ent, 1 ♀, data as for lectotype, but with inventory no. 3887/Ent. (MMB).

**Other material:** INDIA: Gujarat: 3 ♂, 1 ♀, Sasan-Gir, 31.i.1981, C.A. Viraktamath; 1 ♀, Ahwa, 17.i.1981, C.A. Viraktamath; 1 ♀, Waghai, 18.i.1981, C.A. Viraktamath. Maharashtra: 4 ♂, 2 ♀, Poona, 7.xi.1991, C.A. Viraktamath; 1 ♀, Dhond, 2.x.1981, A.R.V. Kumar. Mizoram: 1 ♂, Aizawl, 18.i.1981, C.S.

Wesley. Karnataka: 1 ♂, Yellapur, 12.v.1982, C.A. Viraktamath; 1 ♂, Madhugiri, 6.vii.1980, A.R.V. Kumar; 1 ♀, Hiriyur, 13.viii.1978, C.A. Viraktamath; 2 ♀, Dharwar, 12.vii.1970, C.A. Viraktamath; 1 ♀, Sirguppa, 21.i.1982, A.R.V. Kumar; 1 ♂, 1 ♀, Mudigere, 6.iv.1980, Freidberg, 1 ♂, 21.v.1976, 3 ♂, 1 ♀, 8.i.1986, C.A. Viraktamath; 1 ♂, Gulbarga, 7.ix.1976, C.A. Viraktamath; 2 ♂, Raichur, 12.v.1992 and 24.vii.1992, S. Viraktamath. Kerala: 3 ♂, 1 ♀, 17 km E Trichur, 8.i.1986, C.A. Viraktamath. Meghalaya: 1 ♀, Nongpoh, 762 m, 4.xi.1981, C.A. Viraktamath. Mizoram: 1 ♂, Aizawl, 8.xi.1981, C.S. Wesley (UAS).

**Remarks:** This species is related to *G. appellans* and *G. fumosus*, but can be readily recognised by a pair of apical and a pair of rather asymmetrically curved processes arising at mid-length of the aedeagal shaft on dorsal aspect and the fused subgenital plates being square tipped.

*Goniagnathus quadripinnatus* sp. nov.

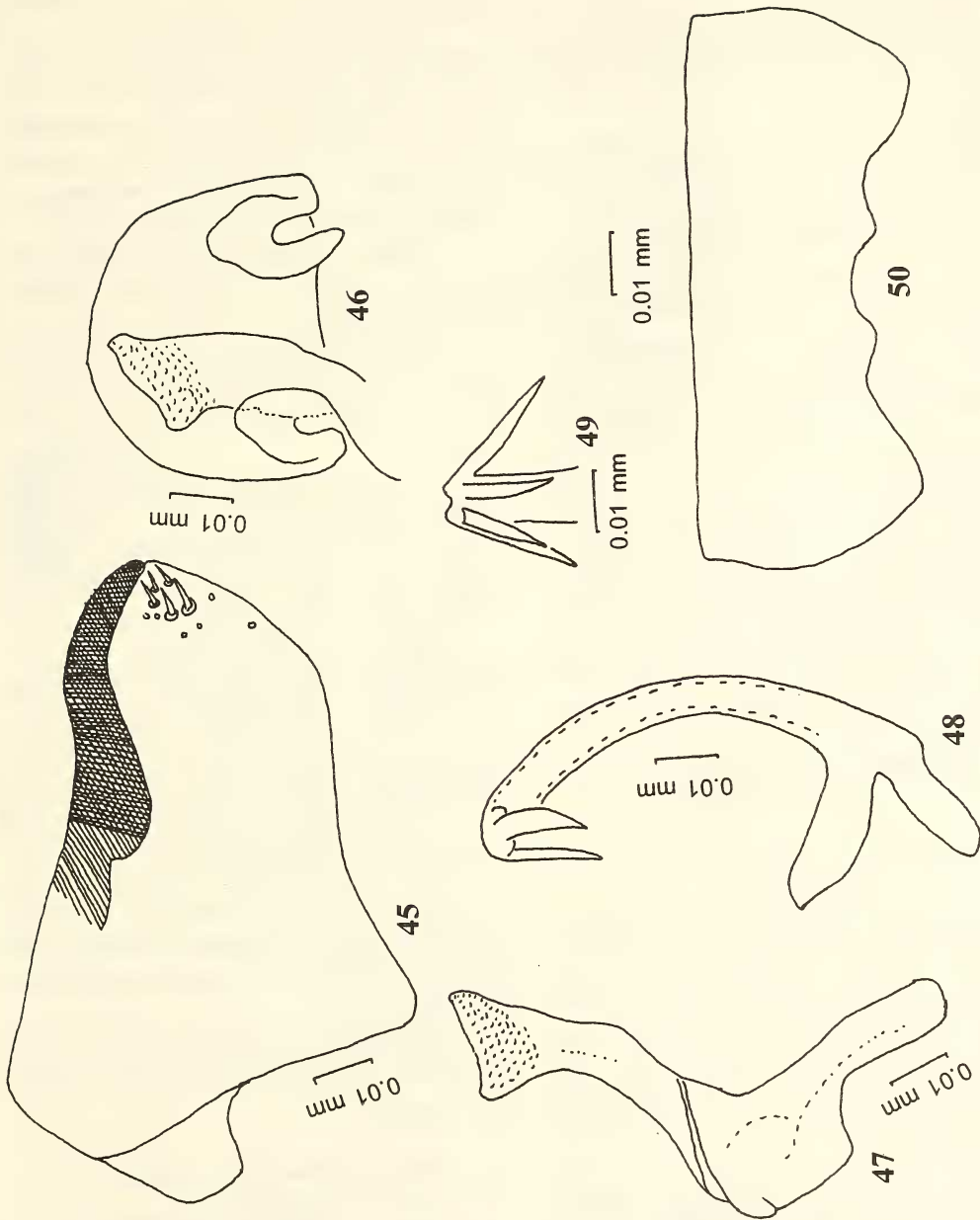
(Figs 45-50)

Ochraceous, faint reddish-brown band on anterior margin of vertex between ocelli. Eyes with reddish margin and stripes. Irregular reddish-brown patches on vertex, pronotum and scutellum. Forewings ochraceous with distinct veins. Pronotum with four and scutellum with two longitudinal reddish stripes.

Vertex three times as wide as long. Forewing with inner anteapical cell closed behind by a cross vein.

**Male genitalia:** Pygophore elongate, caudally narrowed, dorsal appendage not exceeding caudo-dorsal angle. A few macrosetae at dorso-apical area. Fused subgenital plate broader than long, caudally convexly rounded. Apophysis of style bilobed, outer lobe shorter than inner, blunt. Aedeagal shaft tubular, curved dorso-anteriorly, with a pair of slender, elongate, apical and a pair of shorter, lateral, subapical

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Figs 45-50: *Goniathus quadripinnatus* sp. nov.: 45. Male pygophore; 46. Fused subgenital plate and apex of style; 47. Style; 48. Fused connective and aedeagus, lateral view; 49. Apex of aedeagal shaft; 50. Female seventh sternum.

processes; gonopore large; dorsal apodeme 0.33 as long as shaft.

**Female genitalia:** Seventh sternum 3.3 times as wide as long, hind margin concave with obtusely rounded lateral margin and deeply notched in middle.

**Measurements:** MALE: 4.5 mm long, 1.9 mm wide across eyes. FEMALE: 5.1 (4.3-5.5) mm long and 2.2 (2.0-2.5) mm wide across eyes.

**Material examined:** Holotype ♂, INDIA: Karnataka: Chikballapur, 3.viii.1976, B. Mallik (UAS). Paratypes: 1♂, data as in holotype; 2♂, Bangalore, 21.i.1976, C.A. Viraktamath; 1♂, 7 km N Dodballapur, 18.vii.1977, C.A. Viraktamath; 1♂, Gulbarga, 20.viii.1981, A.R.V. Kumar; 1♂, 1♀, Dharwar, 25.vii.1972, C.A. Viraktamath; 1♂, 30.viii.1972, 1♂, 22.iv.1972, C.A. Viraktamath. Orissa: 2♂, Bhubaneswar, 13.vi.1993, P.C. Dash (BMNH, NPC, UAS).

**Remarks:** This species is very similar to *G. appellans* in the structure of male genitalia. However, it differs from *apellans* in having broader subgenital plate, dissimilar lobes of the apophysis of style and slender apical processes of the aedeagal shaft.

**Etymology:** *quadripinnatus* refers to the four apical processes of the aedeagus.

***Goniagnathus symphysis* sp. nov.**

(Figs 51-58)

Ochraceous. Vertex with anterior margin yellowish, a black band touching ocelli, irregularly scattered minute reddish spots, coronal sulcus black. Eyes with ochraceous margin and reddish-brown stripes. Legs with irregular black markings. Forewing ochraceous with distinct greyish veins, claval, veins with irregular black spots.

Vertex 5.5 times as wide as long. Forewing with inner antepical cell closed behind by a cross vein.

**Male genitalia:** Pygophore elongate, caudal lobe produced conically, dorsal appendage

stout, black, a few setae on apical 0.33 of lobe. Fused subgenital plate broader at base than long, with caudal margin rounded. Apophysis of style deeply bilobed, outer lobe slender, more acutely pointed than inner lobe. Aedeagus short, stout, shaft constricted before apex and then broadened, dorsal apodeme 0.33 as long as shaft; gonopore large, round, margined by two sclerotized processes which do not meet apically.

**Female genitalia:** Seventh sternum width 2.7 times its length, hind margin strongly notched in middle.

**Measurements:** MALE: 5.6 (5.3-5.9) mm long, 2.35 (2.3-2.4) mm wide across eyes. FEMALE: 6.1 (5.7-6.7) mm long, 2.5 (2.4-2.6) mm wide across eyes.

**Material examined:** Holotype ♂, INDIA: Gujarat: Waghai, 18.i.1981, C.A. Viraktamath (UAS). Paratypes: 1♂, data as for holotype; INDIA: Gujarat: 2♂, 1♀, Waghai, 18.i.1981, S. Viraktamath (BMNH, NPC, UAS).

**Other material:** Maharashtra: 2♂, Igatpuri, 23.iv.1980. Tamil Nadu: 1♂, Yercaud, 18.ix.1978; 1♀, Shambaganur, 29.x.1975; 1♂, 3♀, 30.x.1975 all coll. C.A. Viraktamath. Karnataka: 1♂, Mudigere, 21.v.1975; 1♂, 1♀, 21.v.1976, B. Mallik; 1♂, Jog Falls, 18.xi.1976, B. Mallik; 2♂, Biligirirangan Hills, 13.viii.1977, 1♂, 9.viii.1977, coll. C.A. Viraktamath (UAS).

**Remarks:** This species can be easily distinguished by the absence of aedeagal shaft processes except for the marginal sclerotisation of gonopore.

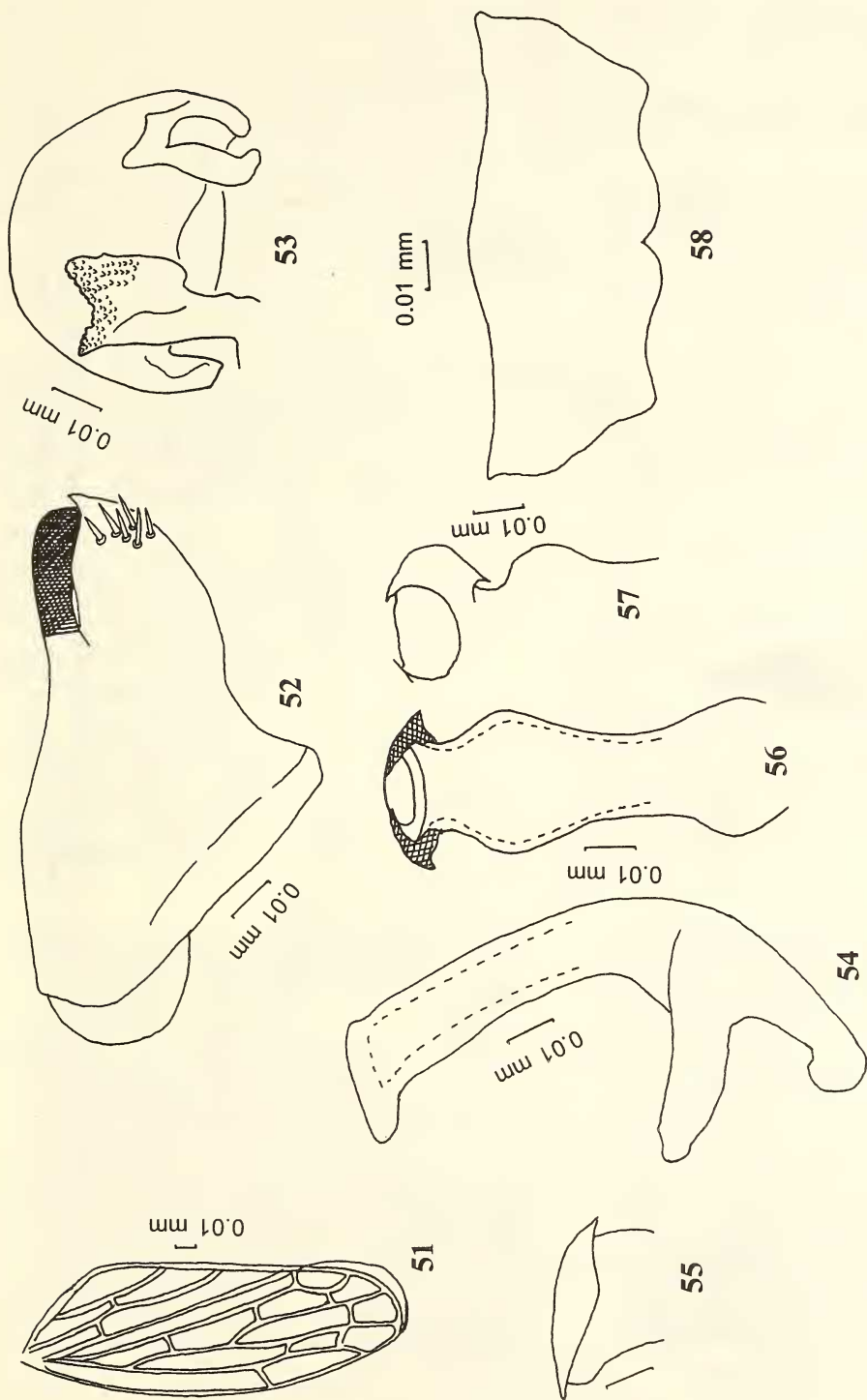
**Etymology:** *symphysis* refers to two processes of the aedeagal shaft which appear glued together.

***Goniagnathus syncerus* sp. nov.**

(Figs 59-65)

Coloration dark brown. Apical margin of head ivory with dorsal and ventral black transverse stripes. Face ochraceous with dark brown transverse stripes on fronto-clypeus. A few

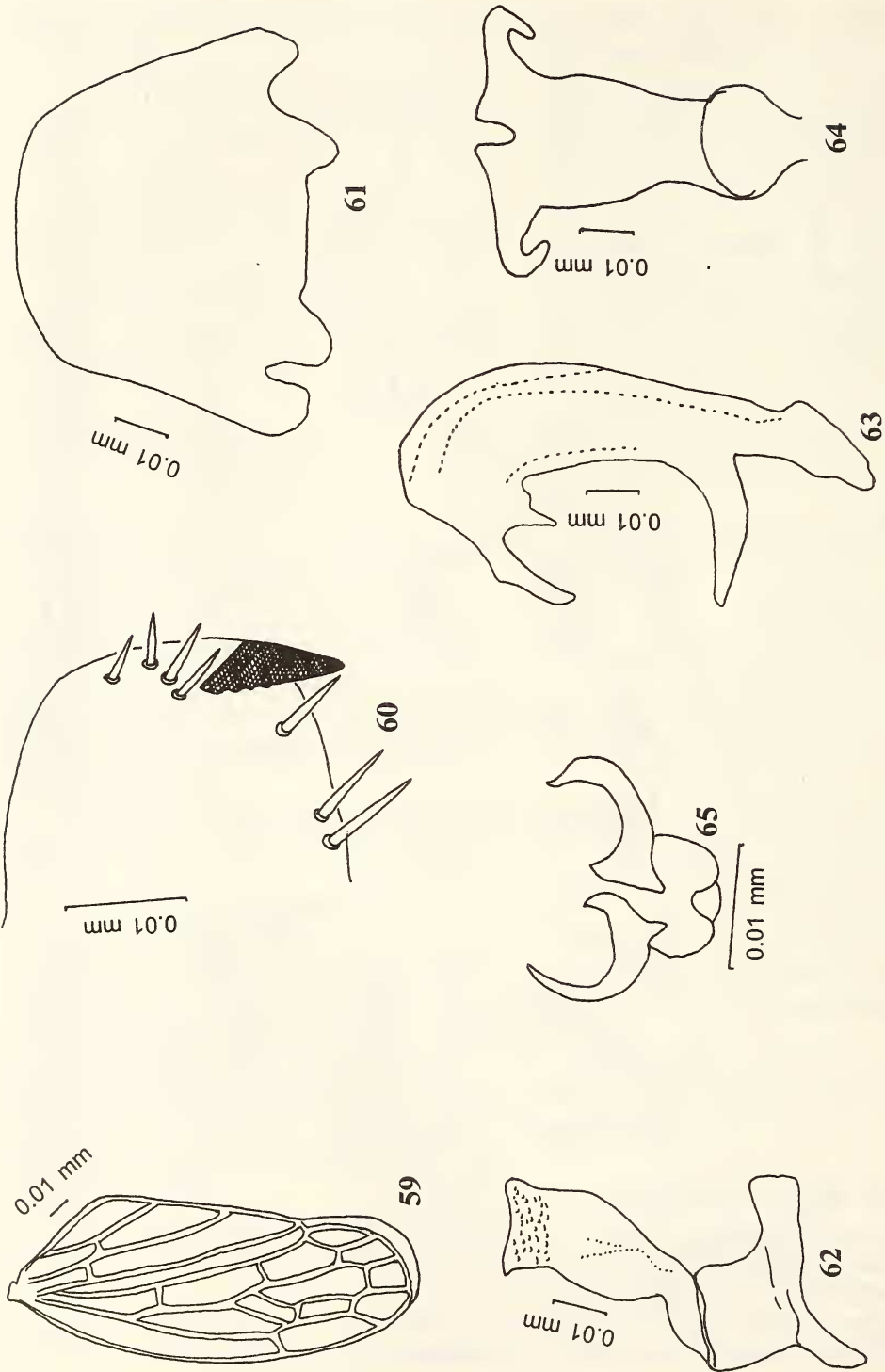
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Figs 51-58. *Goniagnathus symphysis* sp. nov.: 51. Forewing; 52. Male pygophore; 53. Fused subgenital plate and apex of style; 54. Fused connective and aedeagus, lateral view; 55. Apex of aedeagal shaft; 56, 57. Different views of aedeagal shaft; 58. Female seventh sternum. Scale line indicates 0.01 mm.



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Figs 59-65: *Goniagnathus syncerus* sp. nov.: 59. Forewing; 60. Process of male pygophore; 61. Fused subgenital plate; 62. Style; 63. Fused connective and aedeagus, lateral view; 64. Fused connective and aedeagus, cephalic view; 65. Apex of aedeagal shaft.

spots or stripes on genae, lora and clypellus dark brown. Thoracic pleurites with large black patches. Lateral margin of pronotum ivory with submarginal black longitudinal stripes. Forewings mottled with dark brown and white along veins. Fore and middle tibiae transversely banded with dark brown.

Vertex 4.5 times as wide as long. Forewing with inner anteapical cell closed behind by a cross vein, outer anteapical cell divided.

**Male genitalia:** Pygophore caudally truncate without dorsal appendage, with an oblique row of short bristles along caudo-dorsal margin, caudo-ventral angle with a short process. Fused subgenital plate broader basally, with caudal margin medially notched. Caudal margin of apophysis of style, slightly concave. Aedeagal shaft narrow at base, broadest at apical 0.66, with a pair of subapical, black, laterally curved processes, each process with a short basal tooth, dorsal apodeme half as long as shaft.

**Female:** Unknown.

**Measurements:** MALE: 5.3 mm long, 2.3 mm wide across eyes.

**Material examined:** Holotype ♂, INDIA: Rajasthan: Mt. Abu, 1,200 m, 24.i.1981, C.A. Viraktamath (UAS).

**Remarks:** This species can be readily recognised by the distally widened aedeagal shaft.

**Etymology:** *syncerus* refers to the two horn-like aedeagal processes which are together.

***Goniagnathus bicolor* Distant**

*Goniagnathus bicolor* Distant, 1918: 43. Lectotype ♀, India (BMNH, examined).

**Material examined:** Lectotype ♀, "Calcutta" "Distant Coll. 1911-383" "*Goniagnathus bicolor* Distant. Type" here designated (BMNH).

**Remarks:** Judging from the structure of female seventh sternum, this species may prove to be a synonym of *G. fumosus*.

ACKNOWLEDGEMENTS

Dr. M.D. Webb (BMNH) provided information on the type series of the species described by W.L. Distant. Dr Pavel Lauterer (MMB) designated the lectotypes for species described by Dr. L. Melichar on our request and compared some of the illustrations of the species sent to him with the type series of *Goniagnathus* under his care.

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